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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
D21G 1/02, D21F 1/40

A1

(11) International Publication Number: WO 98/12381

(43) International Publication Date: 26 March 1998 (26.03.98)

(21) International Application Number: PCT/FI97/00561

(22) International Filing Date: 19 September 1997 (19.09.97)

(30) Priority Data:

963710	19 September 1996 (19.09.96)	FI
972400	6 June 1997 (06.06.97)	FI

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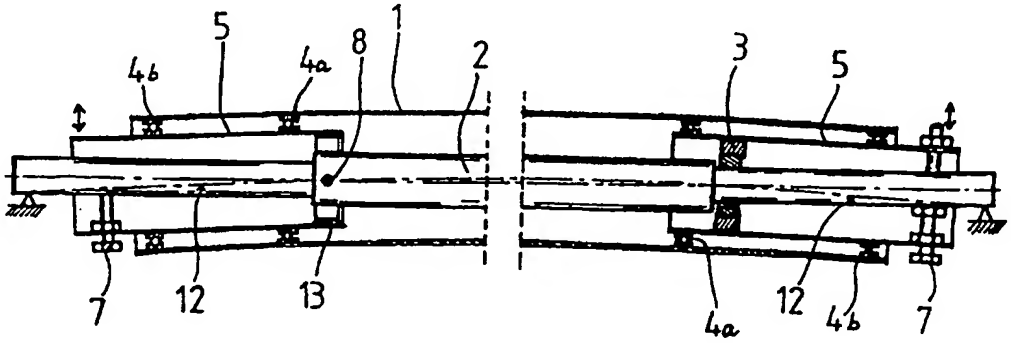
(81) Designated States: CA, CN, JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
With amended claims.
In English translation (filed in Finnish).

(54) Title: A ROLLER FOR GUIDING MOVABLE WEB



(57) Abstract

A roll guiding the travel of paper web, especially in a paper machine, at least a portion of whose mantle tube (1) rotates eccentrically with respect to the roll centre line (12) and the mantle is uniform and its material reinforced plastic or similar composite construction and the roll fitted with bearings by means of adjustable cylinder elements (5). The fitting-with-bearings of both mantle tube (1) ends comprises the said cylinder element, like bushing (5), which is non-rotating and on which at a distance from each other there are two bearings (4a, 4b) fitted to rotate the mantle tube (1) and to make the mantle tube curve by bending it and that there is between cylinder element and axle (2) a joint (8, 3) for adjustment of said cylinder element direction with respect to the said axle or the fastening body.

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A ROLLER FOR GUIDING MOVABLE WEB

This method relates to a rotating roll in accordance with the introductory chapter of patent claim 1.

Previously known is a spreader roll used in contex with paper machine calenders, by means of which the travel of paper web can be guided. The roll comprises three cylinders side by side, each cylinder individually fitted with bearings on a support axle running through all three of them. However, the farthermost cylinders are so fitted with the bearings that the outmost bearings can be moved slightly sideward from the centre line of the support axle. By means of this shifting the three-component roll becomes a construction where the midmost roll is rotating totally around the support axle centre line, but the farthermost rolls can be adjusted into a slightly deflected position, whereby the whole roll axis of rotation is a broken line, but only with a slight change of direction. The bearings used in the farthermost rolls have been ball bearings and adjustment has been possible in moving another journal box.

A roll of this type adjusted to be curving like a broken line and whose cylinders are of steel, has slots between the adjacent cylinders when the farthermost rolls have been adjusted. Even though packings are used in the slots, bearing grease easily trickles out from them onto the paper. The metal roll tube also gets heated at the bearings leaving marks on the paper. Further, by this construction a poor impact tensing and spreading the paper web is produced due to clear points of discontinuity. It is explicitly meant to spread the web sideward by the roll before entering the calender by making the roll middle portion to tense the web at the most and the roll edges less tensing. In making the roll of three or more adjacent cylinders, the tensing effect can be produced only as a broken-line-like profile across on which the paper web

moves.

Further known from the GB-publication 1 332 926 and US patent 3,783,481 is a rotating roll fitted with bearings on a curved non-rotating axle. In these solutions it is difficult to install several bearings one after another on a curved axle and it is not possible to adjust the curvature of the axle. A curved axle, as such, is also difficult to manufacture.

With a roll according to this invention a remarkable improvment of the roll profile and adjustability has been achieved and the slots between the elements in a multielement roll have been omitted. The invention is characterized in what is presented in the patent claims.

The objective of the invention is to eliminate the discontinuities from the roll an this is reached in using reinforced plastic as roll material or a similar composite construction, of which a uniform mantle is made fitted from its ends and most suitably also between them with thrust bearings. The proposed material allows rotation around a slightly curved rotation axis. During rotation the mantle is subjected to alternating stress due to continuous bending. Since in used rolls the required deflection is small, for instance in a six meter roll the deflection of the centre at the roll end is appr. 1 cm, by which such a small spreading during roll rotation is produced that it does not exceed the spreading value of 0,1% permitted for the mantle material.

An adjustment carried out with a roll as per this invention is ideal for paper web. For a standard sized roll a curved and continuous profile is produced on the line where the web touches the roll. Furthermore, the roll is light and inexpensive to manufacture. The mantle curvation can be easily adjusted and fitting with bearings is easily done on one straight or on several straight axles.

In the following the invention is disclosed with reference to the enclosed drawing, where
Fig. 1 is a side section of the roll
Fig. 2 is a side section of the roll, second embodiment
Fig. 3 is a side section of the roll, third embodiment

Figure 1 shows roll 1 of composite construction with a mantle tube 1. The mantle is cylindrical with a standard sized diameter. Within the mantle there is an axle 2, known as such, which is not rotated and which is propped in its position. Axle 2 is not moved during adjustment by means of which the outer profile of the roll is altered. The middle portion of the axle has an enlargment in order to improve its sturdiness. Mantle 1 is a uniform tube.

In figure 1, as an example, one end of the roll is illustrated fitted with an adjustable bearing support different from the one in the other roll end. In both ways it is possible to make the rotation centre of the farthermost bearing deflect from the centre of support axle 2.

In the solution to the left is the end of bushing 5 that supports bearing 4 fitted by a support joint 8 to support axle 2 inside roll 1. Bushing 5 partly extrudes from the roll and by means of adjusting screw 7 the rotation centre of bushing 5 and as well as of bearing 4 is deflected from the support axle centre. The rotation centre of the bearing is on curved line 12 presenting simulataneously the centre line of the bent roll. Bushing 5 must fit firmly in place on axle 2 which means that in addition to adjusting screw 7 bushing 5 must be made immobile by other supporting means as soon as the proper adjustment status has been determined.

The embodiment to the right in figure 1 shows how bushing 5 is fixed on axle 2 by means of ball joint 3. In this case the

rotation of bushing 5 is most suitably prevented by means of adjusting screws 7 running through axle 2.

As per figures 1,2 and 3 mantle 1 of many meters length and supported by four bearings is curved by adjusting the outermost bearing supports into an externally even curvation without any spots of discontinuity. The curvations in practice are so small that a mantle of composite construction can take completely the existing bending stress. During rotation, by each rotation, the mantle must bend twice over a straight line in both directions, i.e. once to the tensile stress state and once to the compression state. The mantle is affected by alternatin stress which, however, may not exceed the permitted spreading value of 0,1%, i.e. the limit given for composite materials.

Figure 2 shows a roll of composite construction with a mantle tube 1. The mantle is cylindrical with a diametre of standard size. Mantle 1 is a uniform tube. The roll construction rests on two firm axles 2a and 2b.

In the embodiment to the left in figure 2 bushing 5 is a bearing solution fastened by joint 8 that includes a fulcrum pin to axle 2a within mantle 1. The pin of joint 8 goes through axle 2a so that its both ends reach bushing 5. There is at end a reinforcing ring 13 with housings for both pin ends. By means of screw 77 bushing 5 can be turned with respect to axle 2a, whereby bearings 4 form a pair of power bending the mantle tube. The rotation centre of bearings 4 is on curved line 12 presenting simultaneously the centre line of the bent mantle.

The attachment of bushing 5 to axle 2 can be improved in using similar extra screws installed beside screw 7. Screws turnable from differing directions from bushing 5 against support axle 2a can be used.

The embodiment to the right in figure 2 shows how bushing 5 is fixed to axle 2b by means of a ball joint 3. In this case the rotation of bushing 5 is most suitably prevented by means of adjusting screws 7 through axle 2b.

In figure 3 bushings 5 are directly fixed to fastenings 14,15,16,17,18 at the roll ends. The fastenings keep the bushings non-rotating but allow turning them around joint 15 in order to bend the mantle. The arrangement is turned activating bracket 16 by means of force F. A proper way is, for instance, to convay screw force T to bracket 16 turning screw 18, whereby bushings 5 also retain their accurately adjusted angle-position when part 14 is locked and made immobile by the screw.

The mantle material is of glass fibre construction or of carbon fibre epoxy composite construction, which makes the mantle light and inexpensive to manufacture. The paper web moving on the mantle rotates the mantle and the tension force of the paper web works as mantle load, the tension force being relatively small, only a few dozens of kiloponds per metre.

PATENT CLAIMS

1.A roll guiding the travel of paper web, especially in a paper machine, at least a portion of whose mantle tube (1) rotates eccentrically with respect to the roll centre line (12) and the mantle is uniform and its material reinforced plastic or similar composite construction and the roll fitted with bearings by means of adjustable cylinder elements (5) for which elements there is as supporting construction an axle (2),(2a) or a fastening body (17),(15),(14) **characterized** in that the fitting-with-bearings of both mantle tube (1) ends comprises the said cylinder element, like bushing (5), which is non-rotating and on which at a distance from each other there are two bearings (4a),(4b) fitted to rotate the mantle tube (1) and to make the mantle tube curve by bending it and that there is between cylinder element (5) and axle (12),(2a) or between cylinder element (5) and fastening body (17) a joint (8),(3),(15) for adjustment of said cylinder element direction with respect to the said axle or the fastening body.

2. A roll according to patent claim 1 **characterized** in that cylinder elements (5) are deflected with respect to another cylinder element within mantle tube (1), like axle (2), using a mechanical adjusting element, for instance screw (7), to carry out deflection.

3. A roll according to patent claim 1 **characterized** in that cylinder elements (5) are deflected with respect to firm axles (2a) reaching from both ends into the roll using a mechanical adjusting element, for instance screw (7), to carry out deflection.

4. A roll according to patent claim 1 **characterized** in that cylinder elements (5) are deflected in supporting the cylinder elements by a supporting structure outside the roll comprising a joint (15) in the firm body (17) for turning the element

(5) and a turning mechanism (16),(18), for instance using screw (18), to carry out deflection of element (5) and fixing the element in the adjusted position.

AMENDED CLAIMS

[received by the International Bureau on 17 February 1998 (17.02.98); original claim 1 amended; remaining claims unchanged (2 pages)]

1. A roll guiding the travel of paper web, especially in a paper machine, at least a portion of whose mantle tube (1) rotates eccentrically with respect to the roll centre line (12) and the mantle is uniform and its material reinforced plastic or similar composite construction and the roll fitted with bearings by means of adjustable cylinder elements (5) for which elements there is as supporting construction an axle (2),(2a,2b) or a fastening body (17),(15),(14) and that there is between cylinder element (5) and axle (2),(2a,2b) or between cylinder element (5) and fasrening body (17) a joint (8), (3),(15) for adjustment of said cylinder element direction with respect to said axle or the fastening body characterized in that the fitting-with-bearings of both ends of the mantle tube (1) comprises said cylinder element, like bushing (5), which is non-rotating and on which at a distance from each other there are two bearings (4a),(4b) fitted to rotate the mantle tube (1) and further only by means of said bearings to make the mantle tube curve by bending it.

2. A roll according to patent claim 1 characterized in that cylinder elements (5) are deflected with respect to another cylinder element within mantle tube (1), like axle (2), using a mechanical adjusting element, for instance screw (7), to carry out deflection.

3. A roll according to patent claim 1 characterized in that cylinder elements (5) are deflected with respect to firm axles (2a) reaching from both ends into the roll using a mechanical adjusting element, for instance screw (7), to carry out deflection.

4. A roll according to patent claim 1 characterized in that cylinder elements (5) are deflected in supporting the cylinder elements by a supporting structure outside the roll comprising a joint (15) in the firm body (17) for turning the element

(5) and a turning mechanism (16),(18), for instance using screw (18), to carry out deflection of element (5) and fixing the element in the adjusted position.

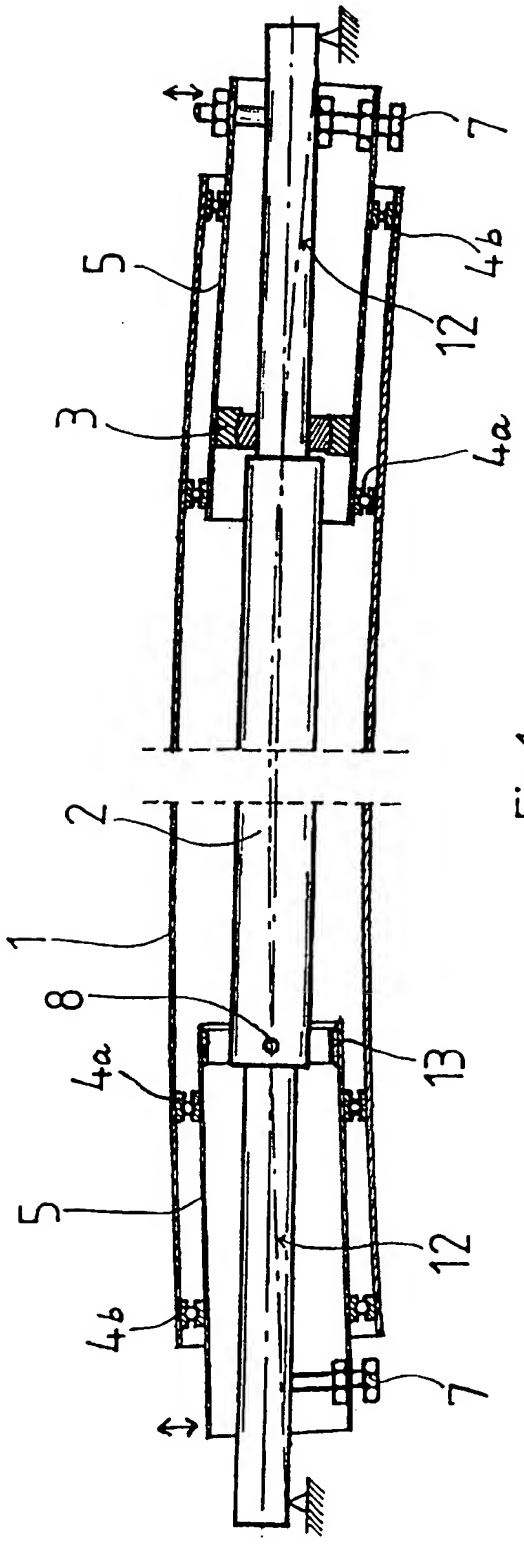

Fig.1

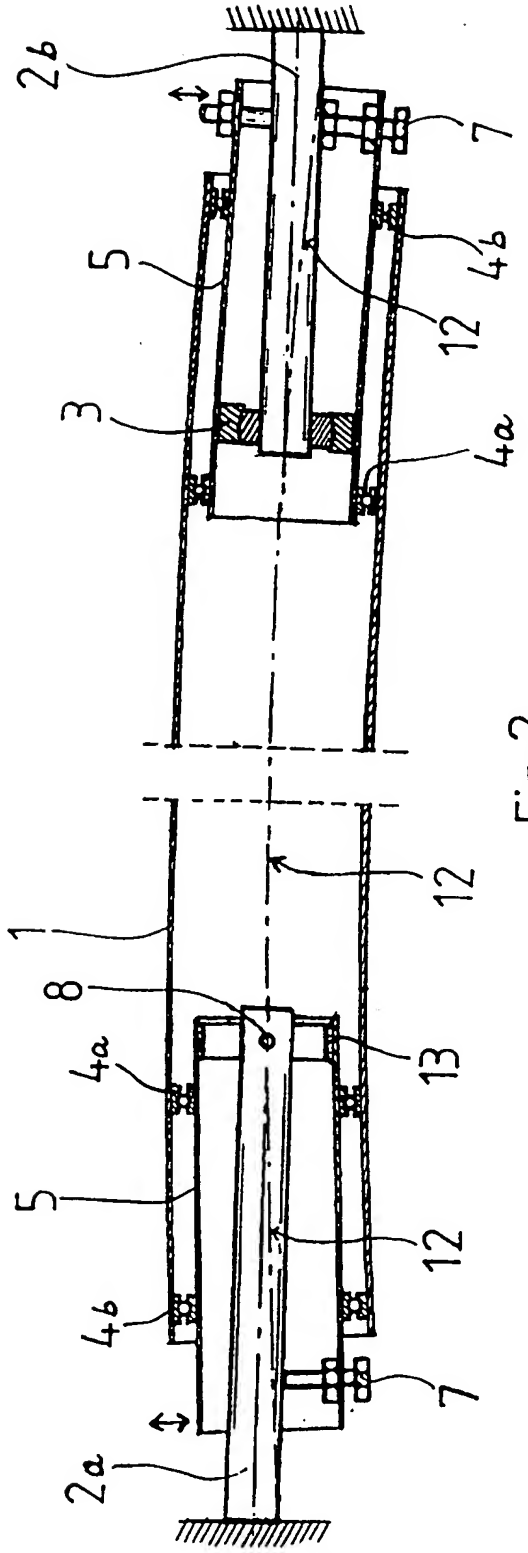

Fig. 2

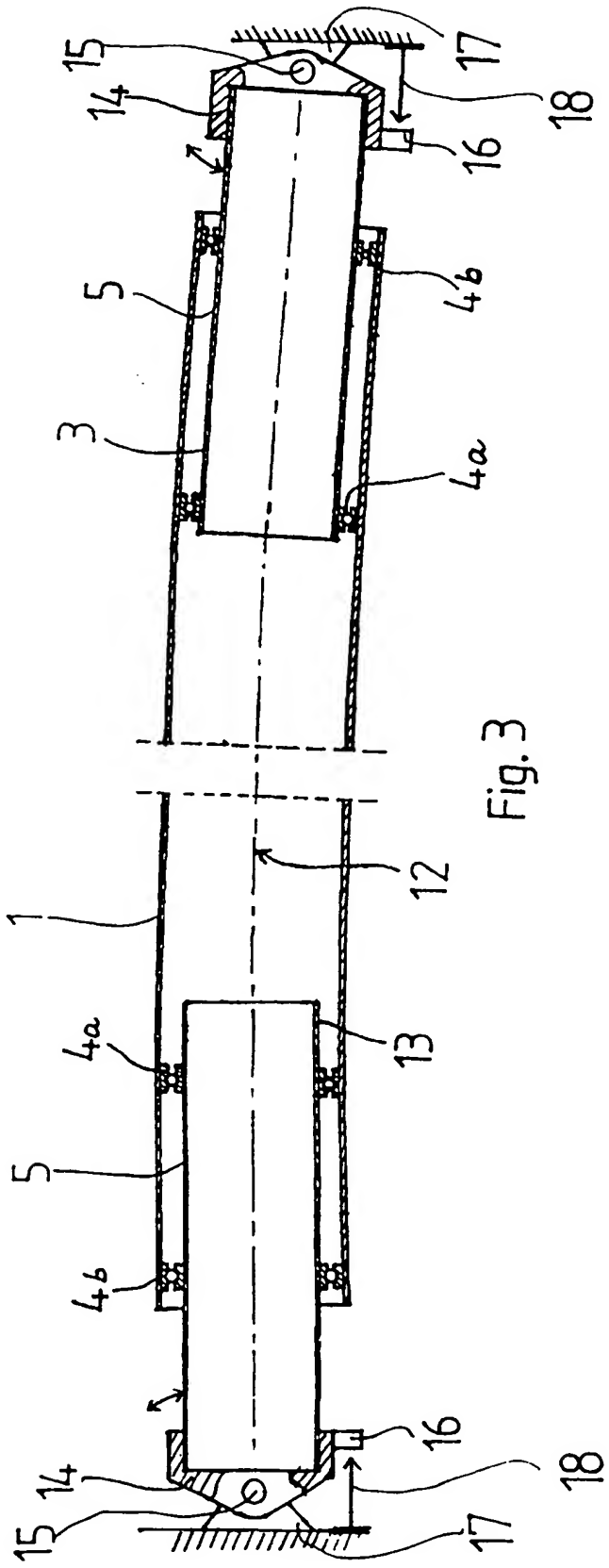

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00561

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21G 1/02, D21F 1/40
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F, D21G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4470183 A (HARRI KUOSA), 11 Sept 1984 (11.09.84), column 2, line 45 - column 3, line 17, figure 1, claims 1-5, abstract -- --------	1,2

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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21 January 1998	21.01.98
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INTERNATIONAL SEARCH REPORT

Information on patent family members

07/01/98

International application No.
PCT/FI 97/00561

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4470183 A	11/09/84	CA 1195539 A	22/10/85
		DE 3221011 A,C	23/12/82
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